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EXAMINER	
PLANTE, JONATHAN R	

ART UNIT	PAPER NUMBER
2182	

NOTIFICATION DATE	DELIVERY MODE
07/09/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/710,526	Applicant(s) HUSEN ET AL.	
	Examiner JONATHAN R. PLANTE	Art Unit 2182	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 April 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13 and 15-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13, 15-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09/21/2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is in response to the Applicant's communication filed 04/16/2008 in response to PTO Office Action mailed 02/06/2008. The Applicant's remarks and amendments to the claims and/or the specification were considered with the results that follow.

Claim Amendments

2. Acknowledgment of receiving amendments to the claims, which were received by the Office on 04/16/2008. Claims 1, 8, 11, and 15 are amended and claim 14 is canceled and no new claims.

The **objections** to the claims have been withdrawn due to amendment filed on 04/16/2008.

The **35 USC § 112 rejection** to claims 11 and 15 have been withdrawn due to amendment filed on 04/16/2008.

3. Applicant is requested to file with the Office a copy of "The Prediction of Gas-Well Performance Including the Effect of Non-Darcy Flow", J. OF PETR. TECH., July 1962 that Applicant cited and relied upon for support in response filed on 04/16/2008.

Claim Objections

4. Claim 8 is objected to because of the following informalities:

a. (Claim 1, Line 4): Please define acronym "PVT" for claim clarity and completeness.

Appropriate correction is required.

Response to Arguments

5. Applicant's arguments with respect to claims 1-13 and 15-18 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. **Claims 1-13 and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roggero et al. (US 6,662,109 B2 December 9, 2003), in view of Wright et al. (US 2003/0205375 A1 November 6, 2003), and in further view of Yu-Shu Wu "Numerical Simulation of Single-Phase and Multiphase Non-Darcy Flow in Porous and Fractured Reservoirs" (2002).**

(Claim 8): Roggero et al. teaches:

a. a. introducing known pressure transient data, well logging data, fracture height and perforation length and PVT data for the well into a base model, **[“calculate the derivatives of the main production results (pressure, saturation, flow rate, etc) in relation to the petrophysical properties (permeability, porosity, etc) assigned to zones of a reservoir” (Column 5, Line 58), “dynamic data are for example production data such as the pressure, the gas-oil ration (GOR) or the fraction of water in the oil” (Column 8, Line 60), “a fine geological model representative of the distribution, in a reservoir, of a physical quantity characteristics of the subsoil structure” (ABSTRACT) and “Techniques for integrating natural fracturing data into fractured reservoir models are also known in the art. Fracturing data are mainly of a geometric nature and include measurements of the density, length, azimuth and tilt of fracture plane” (“Discussion of the Prior Art”, Paragraph 0011)]**

b. b. producing a performance prediction from the base mode, **[parameters of the simulation model are adjusted, this model can be used to simulate the present and future behavior of the reservoir (Column 2, Line 15)]** and

c. c. comparing the performance prediction with actual performance; **[an objective function which measures the difference between the dynamic data observed in the field and the simulation results obtained for a set value of parameters θ (Column 4, Line 30)]**

d. d. modifying the model to generate a performance prediction that matches the actual performance for producing an optimized model. **[constrained reservoir characterization is to determine the parameters of the simulation model so that the latter can reproduce the production data of the reservoir to be modeled. This parameter estimation stage is also referred to as production data fitting. The flow simulation model is thus compatible with all of the available static and dynamic data (Column 1, Line 61)].**

Roggero et al. fails to teach explicitly:

a. an induced fracture height and perforation length
b. introducing non- Darcy factors into the base model

Wright et al. teaches, "an induced fracture height and perforation length" ***[A data acquisition and analysis system to determine induced fracture width and length as well as fracture closure stress, net facture pressure, and facture fluid efficiency (Paragraphs 0197-0200)].***

It would have been obvious to one skilled in the art to combine Roggero et al. with Wright et al. to create a more accurate model of the subterranean well. By including the induced fracture width and height, in addition to orientation relative to the pay zone (e.g. area containing oil) allows for a more accurate model allowing engineers to increase

production in addition to selecting optimized subterranean well locations to take advantage of the induced fracturing of the pay zone.

Roggero et al. and Wright et al. are analogous art in that both Roggero et al. and Wright et al. deal with oil well (subterranean well) modeling and measuring.

Yu-Shu Wu teaches:

a. introducing non-Darcy factors into the base model **["A numerical method as well as a theoretical study of non-Darcy fluid flow through porous and fractured reservoirs is described. The non-Darcy behavior is handled in a three-dimensional, multiphase flow reservoir simulator, while the model formulation incorporates the *Forchheimer* equation for describing single-phase or multiphase non-Darcy flow and displacement. The non-Darcy flow through a fractured reservoir is handled using a general dual-continuum approach. The numerical scheme has been verified by comparing its results against those of analytical methods. Numerical solutions are used to obtain some insight into the physics of non-Darcy flow and displacement in reservoirs. In addition, several type curves are provided for well-test analyses of non-Darcy flow to demonstrate a methodology for modeling this type of flow in porous and fractured rocks, including flow in petroleum and geothermal reservoirs." (Abstract)]**

It would have been obvious to one skilled in the art to combine Roggero et al. with Yu-Shu Wu to create a more accurate model of the subterranean well, by accounting for the Non-Darcy flow in modeling and simulation as taught in Yu-Shu Wu.

Roggero et al. and Yu-Shu Wu are analogous art in that both Roggero et al. and Yu-Shu Wu deal with oil well (subterranean well) modeling and simulation.

(Claim 9): In further view of Claim 8, Wright et al. teaches:

a. wherein the PVT data comprises data for a number of layers involved in the well modeled ***[Depicted in Figure 1 "Facture Zone" (Figure 1, 22) and "Pay Zone" (Figure 1, 16) that are layers involved in the well modeling. Figure 1 also depicts geological layers 14a-e (Paragraph 0169)].***

(Claim 10): In further view of Claim 8, Roggero et al. teaches:

a. wherein optimized model is generated by comparing the performance prediction and actual performance for a first, known zone **[rejected using the same rationale as per the rejection of claim 1]** optimized model is utilized to predict performance data for an unknown zone **[Characterizing a well during operations relating to creating or operating the well can provide various information about what is down hole in the well or adjacent subterranean formations. This information may be used in performing the operation(s)**

on the respective well, or it may be useful in planning or conducting operations on other wells. (0016)].

(Claim 11): In further view of Claim 10, Wright et al. teaches:

a. wherein the optimized model is repeatedly optimized as actual performance data for multiple zones is collected ***[For optimized field development the knowledge of multiple boreholes can be used (Paragraph 0182)].***

However, Wright fails to teach that the model is optimized for multiple zones.

It is obvious to one skilled in the art to combine the teachings of Roggero et al. in Claim 10 with the teachings of Wright in Claim 11 for updating the model using data from multiple zones (boreholes). By updating the model with actual data from multiple zones allows for a more accurate and complete study of the larger oil field where the geography changes across the field.

(Claim 1): In further view of Claim 8, Roggero et al. teaches:

a. a base model **[The simulation model is preferably first calibrated (Column 8, Line 42)]**
b. b. an input device for inputting the well logging data into the base model; **[“allows updating by the dynamic production data, a fine geological model representative of the distribution in the reservoir of a physical quantity**

characteristic of the subsoil structure (the permeability or the porosity of the reservoir rocks for example)" (Column 8, Line 8), "**dynamic data are for example production data such as the pressure, the gas-oil ration (GOR) or the fraction of water in the oil" (Column 8, Line 60)]**

c. c. an input device for inputting the pressure transient data into the base model; **["dynamic data are for example production data such as the pressure, the gas-oil ration (GOR) or the fraction of water in the oil" (Column 8, Line 60)]**

d. d. an input device for inputting the PVT data into the base model; **["allows updating by the dynamic production data, a fine geological model representative of the distribution in the reservoir of a physical quantity characteristic of the subsoil structure (the permeability or the porosity of the reservoir rocks for example)" (Column 8, Line 8),"dynamic data are for example production data such as the pressure, the gas-oil ration (GOR) or the fraction of water in the oil" (Column 8, Line 60), Figures 2, 3, and 5]**

e. e. a numerical interpreter for calculating predicted performance of the well; **[parameters of the simulation model are adjusted, this model can be used to simulate the present and future behavior of the reservoir (Column 2, Line 15)** and **"power of current computers" (Column 2, Line 41)]**

f. f. a match system for comparing actual performance data with calculated predicted performance data based on the base model; and **[an objective function which measures the difference between the dynamic data**

observed in the field and the simulation results obtained for a set value of parameters θ (Column 4, Line 30)]

g. g. a reiterative loop for modifying the base model to provide a match between the actual performance data and the predicted performance data to optimize the base model **[constrained reservoir characterization is to determine the parameters of the simulation model so that the latter can reproduce the production data of the reservoir to be modeled. This parameter estimation stage is also referred to as production data fitting. The flow simulation model is thus compatible with all of the available static and dynamic data (Column 1, Line 61)].**

(Claim 2): In further view of Claim 1, Roggero et al. teaches:

a. further including a data editing module for editing the pressure transient data before it is input into the base model **[as the parameters of the simulation model are adjusted, this model can be used to simulate the present and future behavior of the reservoir (Column 2, Line 16)].**

(Claim 3): In further view of Claim 1, Roggero et al. teaches:

a. further including a plotting device for plotting the data generated by the model system **[Figures 4-7, 10-16, 18-20].**

(Claim 4): In further view of Claim 3, Roggero et al. teaches:

a. wherein the plotting device is adapted for plotting line fitting on specialized plots **[FIGS. 19A to 19E show comparison between the pressure data and the simulation results after fitting (Column 10, Line 7)].**

(Claim 5): In further view of Claim 3, Roggero et al. teaches:

a. wherein the plotting device is adapted for plotting specialized plots providing preliminary estimates of performance data based on the base model **[FIG. 13 shows an initial geostatistical model (Column 9, Line 61)]**.

(Claim 6): In further view of Claim 3, Roggero et al. teaches:

a. wherein the plotting device is adapted for generating a 3D display of the well **[FIG. 16 shows a constrained geostatistical model (Column 10, Line 1)]**.

(Claim 7): In further view of Claim 3, Roggero et al. teaches:

a. wherein the plotting device is adapted for generating performance data plots based on the optimized model" **[FIG. 4 shows the derivatives of the simulation results in relation to the parameterization of the geostatistical model (Column 9, Line 43)]**.

(Claim 12): In further view of Claim 8, Wright et al. teaches:

a. the method further comprising determining the induced fracture height and perforation length according to pressure data observed in conjunction with a

fracture treatment ***[A frac pump is connected to the well head for inducing fracturing, and the tiltmeter array (measuring device) collects continuous data on the induced earth deformation (fracture) verses time (Paragraphs 0197-0198). Where the tiltmeter provides fracture width and height (Paragraph 0200). The tilt meter also provides pressure and temperature data (Paragraph 0218)].***

(Claim 13): In further view of Claim 12, Wright et al. teaches:

a. wherein the PVT data varies within the induced fracture ***[The tilt meter contains sensors for providing pressure and temperature data (Paragraph 0218) and depicted in Figure 29 are multiple tiltmeters (Figure 29, Indexes 134a-134n) that are positioned at varies levels and provide the pressure and temperature data at the varies levels within the fracture zone (perforation zone (Figure 29, 20)].***

(Claim 14): Canceled

(Claim 16): In further view of Claim 8, Wright et al. teaches:

a. wherein the actual performance comprises a pressure transient ***[The application of using tiltmeter to collect data versus time (Paragraph 0025). Where the data collected by the tiltmeter includes fracture growth (volume) (Paragraph 0025) and also pressure and temperature (Paragraph 0218)].***

(Claim 17): In further view of Claim 8, Roggero et al. teaches:

a. wherein the actual performance comprises a production value ***[Using dynamic production data (actual performance data) (Column 8, Line 9) where dynamic data includes production values (data) for pressure, gas-to-oil ratio, and fraction of water in oil (Column 8, Lines 60-63)].***

(Claim 18): In further view of Claim 8, Wright et al. teaches:

a. wherein the pressure transient data comprises pressure transient data resulting from a mini-frac test ***[The tilt meters system provides data acquisition and analysis to map fracture height growth in real-time on mini-frac pumping tests. Where the analysis includes fracture width and length, fracture closure stress, net fracture pressure and fracture fluid efficiency (Paragraph 0200)].***

8. **Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Roggero et al., Wright et al., and Yu-Shu Wu as applied to claims 1-13, and 16-18 above, and further in view of Applicant Admitted Prior Art ("The Prediction of Gas-Well Performance Including the Effect Of Non-Darcy Flow", J. OF PETR. TECH., July 1962).**

(Claim 15): In further view of Claim 14, Yu-Shu Wu teaches:

a. wherein the non-Darcy factors comprise compensation for turbulent gas flow in a fracture **[“Numerical Simulation of Single-Phase and Multiphase Non-Darcy Flow in Porous and Fractured Reservoirs” (Title)]**

Yu-Shu Wu also teaches the application of the following variables used in the simulation/modeling:

a. $C\beta$ non-Darcy flow constant (m3/2), (Page 209)
b. Ff mass flux of fluid f (kgs−1), (Page 209)
c. β, βf non-Darcy flow coefficient of fluid f (m−1), (Page 10)
d. βD dimensionless non-Darcy flow coefficient, (Page 10)
e. βD,f,βD,m dimensionless non-Darcy flow coefficients for fracture and matrix, respectively, (Page 10)

In response to the 35 USC § 112 rejection (Office action 02/06/2008) the Applicant replied in the “Response to Claim Rejections" section with:

> Therefore, Applicants respectfully assert that the inclusion of "non-Darcy factors," such as in original Paragraph 0027, is understood to those of skill in the art to include turbulence and therefore the rejection of Claim 15 under 35 U.S.C. § 112 is improper. (Response to Office Action dated 04/16/2008, Page 8)

The Applicant has admitted as prior art that non-Darcy factors include turbulence and was/is well known in the art as far back at 1962 in respect to "The Prediction of Gas-

Well Performance Including the Effect Of Non-Darcy Flow", J. OF PETR. TECH., July 1962.

Therefore, in response Yu-Shu Wu teaches the application of numerical simulation/modeling of petroleum/geothermal reservoirs using non-Darcy factors which include turbulence based on Applicant's argument above in respect to being well known in the art and as a result is either inherent or obvious to one skilled in the art at the time of the invention.

The Examiner also notes that it would be obvious to one skilled in the art to account for in the model and simulation for material phase changes (e.g. ice to water, liquid to gas). Each chemical compound has specific chemical and physical properties that need to be accounted for when modeling them. Take for example water (H2O) at standard atmospheric pressure and a 32 degrees Fahrenheit water is a liquid but when the temperature is 32 degrees water undergoes a phase change and becomes a solid. If you increase the pressure to above 1 atmospheric pressure the temperature that water solidifies is decreased. The same properties would have been obvious to consider when modeling subterranean wells. When drilling and fracturing the subterranean pressure and temperature are increased or decreased resulting in potential phase changes of the materials, and when pressure is significantly decreased as when inducing fracture materials that where solid at high pressure can rapidly phase change

from solid phase to vapor phase when the pressure is reduced resulting in turbulent gas flow.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

10. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. The examiner requests, in response to this Office action, support be shown for language added to any original claims on amendment and any new claims. That is, indicate support for newly added claim language by specifically pointing to page(s) and line number(s) in the specification and/or drawing figure(s). This will assist the examiner

in prosecuting the application. **Failure to show support can result in a non-compliant response.**

12. When responding to this office action, Applicant is advised that if Applicant traverses an obviousness rejection under 35 U.S.C. 103, a reasoned statement must be included explaining why the Applicant believes the Office has erred substantively as to the factual findings or the conclusion of obviousness See 37 CFR 1.111(b).

Additionally Applicant is further advised to clearly point out the patentable novelty which he or she thinks the claims present, in view of the state of the art disclosed by the references cited or the objections made. He or she must also show how the amendments avoid such references or objections See 37 CFR 1.111(c).

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan R. Plante whose telephone number is (571) 272-9780. The examiner can normally be reached on Monday -- Thursday 10:00 AM to 4:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Tariq Hafiz can be reached on (571) 272-6729. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

14. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. R. P./

Examiner, Art Unit 2182

/Tonia LM Dollinger/

Primary Examiner, Art Unit 2181